PATENT SPECIFICATION

DRAWINGS ATTACHED

1,165,934

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COMPLETE SPECIFICATION

Producing Filamentary Materials by Fibrillation

We, CELANESE CORPORATION, of 522 Fifth Avenue, New York 36, State of New York, United States of America, a company incorporated in accordance with the laws of the State of Delaware, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the production of filamentary materials by a fibrillation process.

Filaments and films made from synthetic thermoplastic linear polymers are commonly drawn to increase their tensile strength in the direction of drawing. This operation causes the development of or an increase in the molecular orientation of the materials but, for this to be significant, the drawing must be effected when the material is solidified or while slightly softened, e.g. by heat or a swelling agent. When such a polymer is extruded in filament or film form the effect on molecular orientation of any draw-down between the point of extrusion and take-up is insignificant.

According to the invention a fibrillated product is produced as a continuous operation by extruding in film form a blend of a molten filament-forming synthetic thermoplastic polymer and a minor proportion of a blowing agent which at the extrusion temperature is itself, or evolves, a gas, drawing the extrudate as it leaves the extrusion die and continuing the drawing while the extrudate is maintained at a temperature above the glass transition temperature of the polymer until fibrillation occurs and solidifying the fibrillated extrudate. That fibrillation can be achieved in this way is surprising and is most advantageous in avoiding the quite severe mechanical treatment of a solid film up till now thought necessary. A small amount of mechanical working can, if desired, be applied to the fibrillated material to enhance its fibrous nature, for instance such as can be achieved by the application of a small degree of false twist.

The process of the invention will be described more particularly in connection with the accompanying drawings wherein Fig. 1 is a schematic illustration of apparatus suitable for use in carrying out the process of the invention.

Fig. 2 is a schematic illustration of apparatus of a kind which must be used to make a fibrillated product without the aid of the invention.

Fig. 3 is a photomicrograph of a cross-section of the extrudate produced with the apparatus illustrated in Fig. 1 and solidified without attenuation.

Fig. 4 is a photomicrograph of the extrudate produced with the apparatus illustrated in Fig. 1, being subjected to attenuation.

Fig. 5 is a photomicrograph of the fully attenuated product produced according with the apparatus illustrated in Fig. 1.

Fig. 6 is a photomicrograph of the finished product produced according with the apparatus illustrated in Fig. 1.

Fig. 7 is a photomicrograph of a cross-section of the product illustrated in Fig. 6.

Referring to Fig. 1, in operation a blend of molten polymer and foaming agent is forced by extruder 1 through a die 2 so as to form a film 3. The temperature of the film 3 is maintained at a satisfactory temperature range, which is above the glass transition temperature of the polymer used, with the aid of fork member 4 by means of which a flow of gas or liquid, preferably air, is directed on to the upper and lower surfaces of the film. The attenuation of the film 3 and the resultant fibrillation takes place as the extrudate leaves die member 2 in film form. If desired the fibrillated product can, after solidification, be caused to undergo mechanical working to a small degree such as may be achieved by slight false twisting effected, for instance, by

[Price 6s 6d]

TABLE I

TENSILE PROPERTIES OF FIBRILLATED POLYPROPYLENE YARN

	Zero t.p.i.*	5 t.p.i.
Denier	723	713
Elongation, %	27	270
Tenacity, g/d	0.7	1.1
Modulus, g/d	14	4

*Tested at Twist Per Inch

TABLE II

TENSILE PROPERTIES OF A SELF-CRIMPED, FIBRILLATED POLYPROPYLENE YARN

(Heat relaxed at 120 to 130°)

	Zero t.p.i.*	5 t.p.i.*
Denier	770	760
Elongation, %	19	106
Tenacity, g/d	0.2	0.4
Modulus, g/d	3.1	2.5
Crimp Elongation, %**	15	11

*Turns Per Inch

**length of fibre in crimped condition over length of the fibre in decrimped condition × 100.

TABLE III

TENSILE PROPERTIES OF FIBRILLATED POLYPROPYLENE YARN

(b) Extruded, Drawn

	Zero t.p.i.*	5 t.p.i.*
Denier	360	360
Elongation, %	17	38
Tenacity, g/d	2.5	3.4
Modulus, g/d	33	23

*Turns Per Inch

TABLE IV

TENSILE PROPERTIES OF FIBRILLATED POLYPROPYLENE YARN

(c) Extruded-Drawn—Twisted (5 t.p.i.)—Redrawn

Denier	240
Elongation, %	26
Tenacity, g/d	4.8
Modulus, g/d	54

WHAT WE CLAIM IS:—

1. Process for the production of a fibrillated product as a continuous operation which comprises extruding in film form a blend of a molten filament-forming synthetic thermoplastic polymer and a minor proportion of a blowing agent which at the extrusion temperature is itself, or evolves, a gas, drawing the extrudate as it leaves the extrusion die and continuing the drawing while the extrudate is maintained at a temperature above the glass transition temperature of the polymer until fibrillation occurs and solidifying the fibrillated extrudate.

2. Process according to Claim 1, wherein the fibrillated product obtained is twisted and then subjected to further drawing.

3. Process according to Claim 1 or 2, wherein the polymer used is polypropylene.

4. Process for the continuous production of a fibrillated product from polypropylene, substantially as described in the Example.

5. Process for the continuous production of fibrillated products, substantially as hereinbefore described.

6. Fibrillated products whenever produced by any of the processes claimed in the preceding claims.

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1165934 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

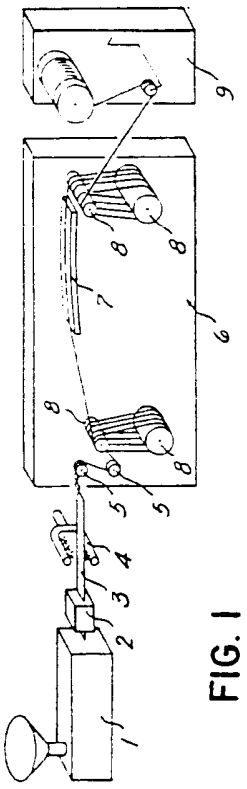

FIG. 1

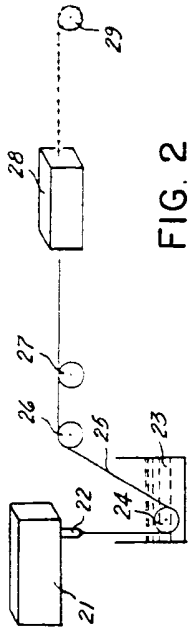

FIG. 2

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Sheet 2

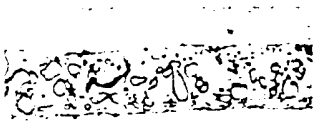

Fig-3

Fig-4

Fig-5

Fig-6

Fig-7